

View-angle dependent AIRS cloud radiances and fluctuations: Implications of organized cloud structures for tropical circulations

Dong L. Wu¹ and Jie Gong²

1. Dong L Wu (伍東亮), Dong.L.Wu@nasa.gov
NASA/Goddard Space Flight Center
8800 Greenbelt Road (for UPS shipments)
Mail Code 613.2
Building 33, Room C313
Greenbelt, MD 20771
Telephone: 301-614-5784
Fax: 301-614-6307

2. (M/S 169-237, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr, Pasadena, CA 91109-8099

Abstract –

Interactions between wave dynamics and moisture generate clouds in a wide range of scales. Organized cloud structures produce statistically asymmetric radiances and perturbations in AIRS and AMSU-B measurements. With high resolution (~14 km beamwidth) and high-sensitivity instruments, these wave-modulated cloud structures can be readily detected from calibrated Level 1 radiance data. In this study we analyzed eight-year (2003 - 2010) statistics of AIRS cloud-induced radiances and found that in tropical convective regions the ascending (13:30 LST) measurements reveal higher view-angle asymmetry in cloud radiance than the descending (1:30 LST). The daytime asymmetry suggests 10% more cloudiness when the instrument views east, implying tilted and banded structures in most of the anvil clouds to which AIRS is sensitive. Such banded cloud structures are likely a manifestation of embedded westward propagating gravity waves in tropical convective systems. More importantly, organized cloud structures carry asymmetric momentum fluxes in addition to energy fluxes, which must be taken into account for modeling wave-wave and wave-mean flow interactions in tropical circulations.